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The Relation of Ossification to Physiological Development

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DURING the growth of an individual we may distinguish increase in size, structural metamorphosis, and the rate of development either in size or structure. During early infancy growth in size is relatively more rapid than structural differentiation. The proportions of the body change comparatively little. During childhood growth in size and structural differentiation to a considerable degree keep pace with one another. As the child grows in height and weight the proportions of the body change, owing largely to relatively slow growth of the head, and rapid growth of the lower extremities. As puberty is approached and during adolescence structural differentiation is more rapid than growth in size although there is usually marked acceleration of growth in size preceding and following puberty. After adolescence slow structural change continues. During early maturity the body becomes stronger, in old age weaker. During the former it usually becomes thicker and heavier, during the latter thinner and shorter.

The changes in size and structure which characterize infancy, childhood, adolescence, maturity and old age demarcate periods of what C. Ward Crampton has designated physiological age in contrast to chronological age.

In dealing with a group of individuals we may determine the average or the mean chronological age at which a given characteristic of physiological age appears and take this chronological age as the "normal" or type age for the appearance of that particular characteristic. Thus, we may find that the first incisor teeth "normally" appear at seven months of age, that the first menstrual period "normally" appears at fourteen years of age. Individuals in whom the first incisor teeth appear earlier than at seven months of age then have an accelerated, those in whom the first teeth appear later a retarded physiological age with

respect to that particular phenomenon. Puberty appearing before fourteen years of age would be accelerated, after fourteen retarded, with respect to fourteen taken as the normal or typical chronological age.

The phenomenon of dentition is relatively definite and simple to observe and record, although teeth apparently otherwise equally developed may break through the gums at different periods and thus interfere with the exactitude in comparing different individuals It has been found, however, that there is a wide variability in dention. The normal or typical age for the appearance of the teeth as determined by one observer is apt to differ considerably from that determined by another observer. Full physical and mental maturity may be reached without the wisdom teeth appearing at all. Dentition is an uncertain indication of general physiological development.

The phenomena which characterize pubescence have received special study by Prof. Crampton from the standpoint of physiological age. These phenomena may enable an expert to form a fairly accurate opinion as to general physiological as contrasted with chronological age but many of them are of such nature that only an expert could make successful use of them. The most definite phenomenon characterizing puberty is the beginning of menstruation. It is well known that the chronological period at which this occurs is subject to wide variation. A retarded beginning of menstruation is not necessarily associated with a general physiological retardation, an accelerated puberty with a general physiological acceleration. Prof. Crampton's investigation indicates, however, that this is most frequently the case. Wensenberg (1911) states that menstruating girls thirteen years of age usually have the stature normal for fifteen-year-old girls, while fifteen-year-old girls who have not menstruated are usually of sub-normal stature. His studies were carried out on South Russian Jewesses.

The phenomena of growth marked by increase of stature and of weight are those most frequently used in the study of acceleration and retardation in physiological development. A considerable number of investigators have studied the correlation between school grade and acceleration and retardation in growth in stature and weight. In most cases the correlation has been found to be positive. As a rule children advanced for their age in school are on the average relatively large in stature and weight, backward children are on the average relatively small. There are, however, many individual exceptions and some investigators have failed to find a positive correlation.

Crampton's observations support the view that there is a closer correlation between such phe-

nomena as dentition and pubescence and growth in height and weight than there is between them and chronological age. If we could measure stature during childhood in terms of percentage of the adult stature which heredity has in store, rather than by comparing the stature reached by an individual of a given age with the average absolute stature for that age, we should probably find stature a still better index of general physiological development. Thus, if we should assume that a child of two years of age normally has half the stature of the adult, and we knew what the normal adult stature of a given child as determined by heredity would be, we could say that a child of two with less than half this adult stature was retarded, with more than half this adult stature was accelerated in development. Unfortunately, we have at present no means of determining what the normal adult stature for a given child may be. We may get some help from a consideration of his parentage and race but this help is quite limited in value.

Another method of determining physiological development is based on a study of relative sitting height. From infancy to puberty the lower extremities grow relatively fast. The rapid growth of the lower extremities causes the relative sitting height, (sitting compared with stature) to decrease. Of two children of the same stature but differing in sitting height the child with the shorter legs and greater sitting height is in this respect relatively less developed, more infantile, than the child with the longer legs. As a rule of two children of the same stature but differing in age, the younger child before puberty has the greater sitting height and shorter legs. There are, however, many exceptions and relative sitting height offers an uncertain method of estimating general physiological development.

The use of relative sitting height in the determination of physiological age is but an indirect method of studying skeletal differentiation as an index of physiological development. The use of the x-rays offers a much more simple and direct method of determining relative skeletal development. By means of the x-rays one may study the extent of ossification of as many of the bones of the body as may seem desirable in any given case. Thomas M. Rotch (1910) advanced the view that the extent of ossification of the bones is the best means we have of determining the relative development of the body. If this were true the admission of children to school and of adolescents to industry might better be based on a radiograph than on a birth certificate. The study, the results of which I desire to place before you today, is an effort to determine to what extent Rotch's theory can be accepted.

This study carried out under

my direction by one of my pupils, Mr. Ernest Donald, represents an attempt to correlate the ossification of the carpal bones with age, height and weight in a group of 167 school children, 96 boys, 71 girls, ranging in age from 3.5 up to 13.5 years. A full report of the study is given by Mr. Donald in a thesis deposited in the University library. Dr. Howard Curl, instructor in roentgenology at the University of Wisconsin kindly took the radiographs on which the work is based.

The ossification of the corpus has been carefully studied by Pryor. Pryor found that, as a rule, centers of ossification appear in the carpal bones in the following order; capitate, hamate, triquetral, lunate, navicular, lesser multangular, greater multangular, pisiform. In the old nomenclature with which many of the present are more familiar the order is as follows: os magnum, unciform, cuneiform, semilunar, scaphoid, trapezoid, trapezium, pisiform. According to Pryor in boys centers of ossification for the capitate (os magnum) and hamate (unciform) always appear before five years of age, the center for the triquetral (cuneiform) usually appears at five, that of the lunate (semilunar, at 5.5, for the navicular (scaphoid) at 6, for the lesser multangular (trapezoid) at 7, for the greater multangular (trapezium) at 8 and for the pisiform at 12.

In girls, according to Pryor, the centers appear in the same order, but about two years earlier than in boys.

The present studies show an order of appearance of centers of ossification similar to that described by Pryor, but, do not disclose so early an average appearance of these centers nor so great a difference between the sexes.

In order to make finer subdivisions in stages of ossification of the carpus than one marked by the mere presence or absence of a center of ossification, the ossification of each center was classified according to extent of ossification into one of four groups A. B. C. and D. Those in group A show on the radiograph large dense centers of ossification, those in group D centers of ossification barely visible. Groups B and C are intermediate. With this grouping as a basis the ossification of the corpus was divided into the following stages:

Stage 1. Capitate (os magnum)and hamate (unciform) in class C. All others unossified.

Stage 2. Capitate (os magnum), hamate (unciform) and triquetral (cuneiform) in class C. All others unossified.

Stage 3. Capitate (os magnum), hamate (unciform) triquetral (cuneiform) and lunate (semilunar) in class C. All others unossified.

Stage 4. .The pisiform and two of the three following bones unossified multangulum majus (trapezium) multangulum minus

(trapezoid) and navicular (scaphoid).

Stage 5. All carpal bones in classes B or C except pisiform which is always unossified and the multangulum majus (trapezium) which may be in class D or unossified.

Stage 6. All carpal bones in class B except multangulum majus (trapezium) and multangulum minus (trapezoid) which are in class C and the pisiform which is unossified.

Stage 7. All the carpals in class B except the pisiform which is in class D or is unossified.

Stage 8. Capitate (os magnum) and hamate (unciform) in class A. Others in class B except pisiform which is in class D or unossified.

Stage 9. All carpals in class A except pisiform which is in class D.

Stage 10. All carpals in class A except pisiform which is in class B.

Stage 11. All carpals in class A.

Individuals in which there is a distinct difference in stage of ossification in the two wrists are relatively infrequent. Four such cases occurred in 96 boys examined. One boy, age 12.5, had the left carpus in stage 10, the right in stage 9. One boy, age 8, had the right carpus in stage 5, the left in stage 4, while in another boy of the same age the left carpus was in stage 5, the right in stage 4. In one boy, age 6, the left carpus was in stage 5, the right in stage 4. Of 71 girls studied, in two there was a difference of ossification in the carpus. In one, age 12, the right carpus was in stage 10, the left in stage 11. In one girl, age 6, the right carpus was at stage 5, the left at stage 4.

TABLE I.
Extent of Ossification of

Stage	Number M.	Number F.	Capitate (os magnum)	Hamate (unciform)	Triquetral (cuneiform)	Lunate (semi-lunar)	Navicular (scaphoid)	Mult. minus (trapezoid)	Mult. majus (trapezium)	Pisiform	Ave. Age Years M.	Ave. Age Years F.
I	2	..	C	C	O	O	O	O	O	O	5.3	..
II	3	..	C	C	C or D	O	O	O	O	O	5.5	..
III	5	..	C	C	C	C or D	O	O	O	O	6.3	..
IV	7	3	B	C	C	C or D	O	O	D	O	6.6	5.7
V	7	9	B	B	B	B or C	B or C	C or D	D or O	O	7.4	6.6
VI	12	19	B	B	B	B	B	C	C	O	8	7.5
VII	15	2	B	B	B	B	B	B	B	O or D	8.7	8.8*
VIII	20	11	A	A	B	B	B	B	B	D or O	10	10
IX	12	2	A	A	A	A	A	A or B	A or B	D	10.8	11.3*
X	6	6	A	A	A	A	A	A	A	B	12.3	10.8
XI	7	19	A	A	A	A	A	A	A	A	12.7	12.5

*—Only two cases for each.

In case of the boys this grouping by stages corresponds well with the grouping by stature, by weight and by age (See Table II). The average stature, average weight and average age for each ossification group is successively greater from stage 1 to stage 11

In case of the girls those at stage 9 are taller, heavier and older than those at stage 10, those at stage 7 are shorter and lighter though older than those at stage 6. There are, however, only two girls with ossification at stage 7 and only two girls with ossification at stage 9. These small numbers probably account for the serial discrepancy.

While averages thus show a fair correspondence between growth in stature and weight and in age on the one hand and stages of ossification on the other hand, individual variations are wide. See Table II.) Thus of 20 boys at stage 8 with an average age of 10 years the youngest was 8 years, the oldest 11 years, 5 months, with an average stature of 53.6 inches, the tallest was 60 inches, the shortest 47 inches; with an average weight of 65.2 pounds, the lightest weighed 52 pounds, the heaviest 80 pounds. Of 19 girls at stage 6, with an average age of 7 years, 6 months, the youngest was 6 years of age, the oldest 10 years, 5 months; the shortest was 45 inches tall, the tallest 52 inches tall; the lightest weighed 41 pounds, the heaviest 68 pounds.

If we compare the stature of the individuals of a group of a given age in years with the average stature of that group, we may divide the individuals into three groups, those of average stature to within an inch for age in the group studied, those of greater

TABLE II.

Relation of Stages of Ossification to Stature, Weight and Age.

Stage	No. of Cases		STATURE—INCHES						WEIGHT—POUNDS						AGE—YEARS AND MONTHS					
			MALE			FEMALE			MALE			FEMALE			MALE			FEMALE		
	M.	F.	Ave.	Tallest	Shortest	Ave.	Tallest	Shortest	Ave.	Heaviest	Lightest	Ave.	Heaviest	Lightest	Ave.	Oldest	Youngest	Ave.	Oldest	Youngest
I	2	..	40.8	44	37	..	..	..	39.5	45	33	..	..	..	5–3	6–8	3–6	..	..	..
II	3	..	42	44	39	..	..	..	39	43	32	..	..	..	5–6	6	4	..	..	..
III	5	..	45	45.5	44.5	..	..	..	45.2	56	40	..	..	..	6–4	7	6	..	..	..
IV	7	3	46	49	41	41.4	43	39	45.3	52	34	36	43	32	6–7	8	5–5	5–8	8	3–5
V	7	9	47	49	41	45.1	47	42	47.7	54	42	45.4	53	42	7–5	8	6	6–7	8	6
VI	12	19	49.75	52	44	49.4	52	45	55	63	45	53.6	68	41	8	9–5	6	7–6	10–5	6
VII	15	2	50.75	52	46	47	48.5	45.5	59	65	47	48	48.5	47.5	8–8	12–5	6–5	8–10	9–2	8–7
VIII	20	11	53.6	60	47	53	56	49	65.2	80	52	63.25	73	60	10	11–5	8	10	11–5	7
IX	12	2	56	61	52	56.25	56.5	56	80.75	105	60	75	75	75	10–9	12–5	9–5	11–3	11–4	11–3
X	6	6	57.5	59	56	53.3	57	50	83.85	93	78	69.6	85	55	12–3	13	8–6	10–10	12	10
XI	7	19	61.75	66	57	57	67	53	96.75	112	73	92	122	66	12–8	13–5	10	12–6	13–5	11
Total	96	71																		

and those of lesser stature. (See Table III.) On this basis we find 30 per cent of the boys studied accelerated in stature, 56 per cent of normal stature and 14 per cent retarded in stature. Of those accelerated in stature 82 per cent showed an acceleration of weight of one or more pounds; 61 per cent an acceleration of ossification; 18 per cent showed average weight for age, 36 per cent average ossification; none retarded weight, 3 per cent a retarded ossification. Of those of average stature, 17 per cent showed accelerated weight, 23.5 per cent an accelerated ossification; 59.5 per cent average weight, 63 per cent average ossification; 23.5 per cent retarded weight, 13.5 per cent a retarded ossification. Of those retarded in stature none showed accelerated weight or ossification, 15 per cent showed average weight, 60 per cent average ossification, 85 per cent retarded weight, 40 per cent a retarded ossification. Of the girls 18.5 per cent were accelerated in stature, 64.5 per cent of average stature, 17 per cent retarded in stature. Of those accelerated in stature, 92 per cent were accelerated in weight, 31 per cent accelerated in ossification; 8 per cent were average in weight, 52 per cent of average ossification; none were retarded in weight, 17 per cent in ossification. Of those of normal stature, 22 per cent showed acceleration in weight, 9 per cent in ossification; 69 per cent, average weight; 76 per cent average ossification; 9 per cent retarded weight, 15 per cent retarded ossification. Of those retarded in stature, 8 per cent were accelerated in weight, none in ossification; 58 per cent were average in weight, 42 per cent in ossification, 34 per cent were retarded in weight, 58 per cent in ossification. Generally speaking, therefore, correlation between retardation and acceleration in stature and that in ossification of the wrist is comparatively low, and is in contrast to the correlation between retardation and acceleration in stature and that in weight, which is generally high in the same group. In some instances, however, the correlation between stature and ossification is closer than that between stature and weight.

TABLE III.

Relation of acceleration in stature to acceleration in weight and in ossification.

		NINETY-TWO MALES	
STATURE		WEIGHT	OSSIFICATION
Acceleration— 30 per cent	Acceleration	82 per cent	61 per cent
	Average	18 per cent	36 per cent
	Retardation	0 per cent	3 per cent
Average— 56 per cent	Acceleration	17 per cent	23.5 per cent
	Average	59.5 per cent	63 per cent
	Retardation	23.5 per cent	13.5 per cent
Retardation— 14 per cent	Acceleration	0 per cent	0 per cent
	Average	15 per cent	60 per cent
	Retardation	85 per cent	40 per cent

SEVENTY FEMALES

STATURE		WEIGHT	OSSIFICATION
Acceleration— 18.5 per cent	Acceleration	92 per cent	31 per cent
	Average	8 per cent	52 per cent
	Retardation	0 per cent	17 per cent
Average— 64.5 per cent	Acceleration	22 per cent	9 per cent
	Average	69 per cent	76 per cent
	Retardation	9 per cent	15 per cent
Retardation— 17 per cent	Acceleration	8 per cent	0 per cent
	Average	58 per cent	42 per cent
	Retardation	34 per cent	58 per cent

If we subdivide the children studied into groups based on acceleration or retardation in stature compared with averages for a given age such as those of the Boas Burk table, the closer correlation between stature and weight than that between stature and ossification becomes much more marked than in the procedure cited above.

We may therefore, conclude that ossification does not afford a practical method of judging general relative physiological development. Within comparatively wide limits, variation in the age at which centers of ossification appear is independent of those factors which produce acceleration or retardation of growth in stature and weight. One has no right on the basis of present knowledge to judge a child generally backward because centers of ossification in the carpus appear relatively late.

Presented as thesis for the Honorary Fellowship Degree of the Radiological Society at Chicago, December, 1920.

Conclusions Drawn From The Consideration of Eighty Cases of Pneumoperitoneum

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THE radiographic examination of the intra-abdominal organs by the aid of pneumoperitoneum, or gas inserted into the peritoneal cavity, is a procedure so recently advocated that it seems advisable for anyone having utilized this method to relate his findings. Since this method was first brought into prominence in this country by Drs. Stewart and Stein of New York, in the early part of 1919, it has been taken up by many roentgenologists and surgeons with a great deal of enthusiasm. The wide range of possibilities which this method affords in the differential diagnosis of obscure intra-abdominal conditions has been welcomed by the roentgenologists who realize only too well the limitations of radiological examination of this part of the body. With the same over-enthusiasm which characterizes nearly every new method of examination, this method has been seized upon by many as the method of choice in investigation of all intra-abdominal conditions. This is by no means the case, and its indescriminate use can only lead to failure and disappointment. Wherever, therefore, this method is used, it should be used, not to supplant other established methods of examination, but only as an additional aid after these fail to give the desired information, or where their use would obviously be of no avail.

In the first place, it is not possible to secure the same information obtainable by the other established methods of examination, by this means, for, it cannot be used in lieu of a barium meal examination for lesions of the gastro-intestinal tract, nor will it render tumor masses of the pyloric end of the stomach visible. It should not be used to secure a plate of the kidneys unless the kidney outline cannot be made out and there is a definite undetermined shadow suspicious of a urinary stone or other kidney disease present. It may be necessary for the differentiation of shadows, suspicious of urinary stones, where the ureters, for some reason or other, cannot be catheterized. I do not

feel that the inflation of the abdominal cavity with air is attendant with more danger than ureteral catheterization and injection. Surely this method would seldom, if ever, be justified for a lateral plate of the spine, unless under some exceptional condition for the fifth lumbar vertebra. This method should not be used for the demonstration of gall stones until definite effort has been made to demonstrate the stones in the usual manner. Where a pathological gallbladder is still suspected, and ordinary examination has revealed nothing, or if the regular method of examination has disclosed a suspicious shadow, then pneumoperitoneum is justified in an effort to localize the shadow to the gallbladder area.

Secondly: While no untoward result has so far occurred, still there is always a certain amount of risk connected with inserting a needle into the peritoneal cavity, especially where the intra-abdominal condition prevailing is unknown, and the indiscriminate use of this method will undoubtedly culminate in some accident.

Thirdly: There is a certain amount of discomfort associated with the procedure—not much, to be sure, but still sufficient to warrant its not being used unless indicated.

Fourthly: The promiscuous use of this method in an attempt to diagnose all intra-abdominal lesions will only lead to failure and disappointment, and a discrediting of this method of examination.

I do not wish this to be interpreted as a discredit to pneumoperitoneum, but I mean it merely as a warning that this method, like all others, has its definite indications, and likewise, its definite limitations.

As a basis for determining the conditions in which we have found the method most useful, I have divided our cases into six groups.

The first group is rather large, and embraces those cases in which information is desired concerning the presence, position, size, form and mobility of the intra-abdominal organs.

The second is composed of cases in which there are masses of undetermined origin (other than those arising from the stomach or large bowel). This group is one in which the method is probably most useful in determining the point of origin of definite palpable masses. It is probably the only means at our disposal by which the retroperitoneal character of a mass can be definitely established.

The third includes cases of kidney or ureter involvement after other methods have not yielded the desired information. For instance, where there is a constant shadow suspicious of stone over the supposed kidney area, and the ureter and kidney pelvis cannot be injected, this method serves to localize the shadow to the kidney area.

The advisability of placing in the fourth group the conditions in which pneumoperitoneum will be an aid, can only be determined after a long time has elapsed and many examinations made. I refer to the examination of the gallbladder. I feel that this method will ultimately prove of great aid in the detection of infected, or pathological gallbladders, and in gall stones. It should, of course, be used only after the ordinary methods fail, and may be of use in doubtful cases, in localizing suspicious shadows to the gallbladder.

In the fifth group I have placed those cases in which adhesions are present—postoperative or otherwise—to the abdominal wall or other viscera. In this group pneumoperitoneum is of all methods the most satisfactory.

In the sixth and last group, it might be well to place cases of subdiaphragmatic conditions, where it is desired to ascertain whether the lesion is above or below the diaphragm, or whether this region is involved at all.

Having considered the indications and contraindications of this method, I will pass to a brief description of our procedure and a few cases in which this method has been useful.

The preparation of the patient is the first thing to be considered. All patients who are to be examined by pneumoperitoneum should be given a cathartic the night before, and an enema the next morning. They should be allowed a light breakfast, and just prior to examination should be catheterized or caused to void. The patient is then prepared for inflation. The skin is prepared in the ordinary manner as for a thorocentesis, soap and water, alcohol and iodine; and a sterile lumbar puncture needle is inserted into the abdominal cavity in the lower left quadrant, directed slightly upward. The lower left quadrant is chosen because of the lessened likelihood of damaging any of the solid intra-abdominal organs, and the needle is directed upward so as not to put the omentum or any organ with mesenteric attachment on a strain, if the needle should accidently come in contact with them. The air rising to the top, displaces or envelopes the abdominal organs, and causes them to be thrown out in relief by reason of the varying radiographic densities thus established. We have discontinued the use of manometers and all other measuring devices for determining the amount of pressure of gas inserted, having found them unnecessary and useless; and find that such a simple apparatus as that shown in Figure I, is perfectly satisfactory. An ordinary lumbar puncture needle is attached by suitable connectors to the pump of a Potain Aspirator, or oxygen tank, depending on the type of gas to be used, with some sort of a trap interposed, such as a Murphy drip with the small vent hole plugged. The purpose of interposing a trap is to

avoid the possibility of introducing foreign material from the pump or tank of gas. We use as a criterion of proper distention, the slight rounding of the abdomen and development of a tympanitic note over the solid organs. If a mass be present, inflation must be continued until there is a tympanitic note over the mass if its adherence to the abdominal wall is to be determined. A very satisfactory method of gauging proper distention for the individual case, and one which we have adopted as a routine, is to inflate under the fluoroscope.

ity to be ideal as an injecting agent. As a result of the injection of these two mediums—air and oxygen—we have been impressed with the fact that although air takes longer to absorb than oxygen, it causes less pain and discomfort to the patient. When the desired amount of inflation is obtained the needle is withdrawn and the examination proceeded with. Details of the technique utilized have been so ably presented in previous publications (Drs. Stewart and Stein) that I will pass over this phase and consider rather the conditions in

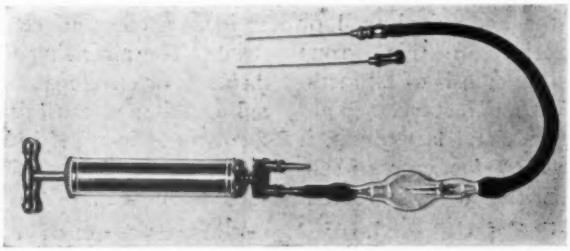

Fig. 1.—Apparatus used for production of pneumoperitoneum. An ordinary lumbar puncture needle fitted to the pump of a Potain aspirator by suitable rubber tubing and connectors, with a Murphy drip interposed as a trap.

The injecting materials which we employ are air and oxygen. We do not use carbondioxide since it is absorbed too rapidly for a satisfactory examination. It seems possible that we may be able to secure a proper dilution of carbondioxide with air which will retard absorption long enough to permit a proper examination, and yet retain enough absorbtive qual-

which we have found it useful. be placed in six groups.

The first group having to do with the presence, position, size, form and mobility of the abdominal organs, is obviously a very large one, and in view of the limited number of examinations made so far, presents certain difficulties; for instance, as to the range of normal mobility or variation

in size or form of different organs in individuals of different age or habits. Only after a large number of observations can these points be established with any degree of accuracy.

Figure 2 represents the relation of the abdominal organs in a normal individual. The liver, spleen, kidneys, psoas muscles, descending colon are partially filled with barium, and both diaphragms are well shown. The liver and spleen are seen displaced somewhat from the diaphragm, but this varies with the degree of inflation. The spleen is about normal in size, and yet very much larger spleens have been observed in otherwise apparently normal individuals. In otherwise normal individuals the liver has been encountered much smaller than shown here, and often confined entirely to the right side. Disproportionate variation in the size of normal kidneys has not been noted. The outline of the normal liver is smooth and any variation from the normal can be readily detected. Figure 3 shows numerous secondary carcinomatous nodules too small to produce definite palpable masses, studding the surface of the liver.

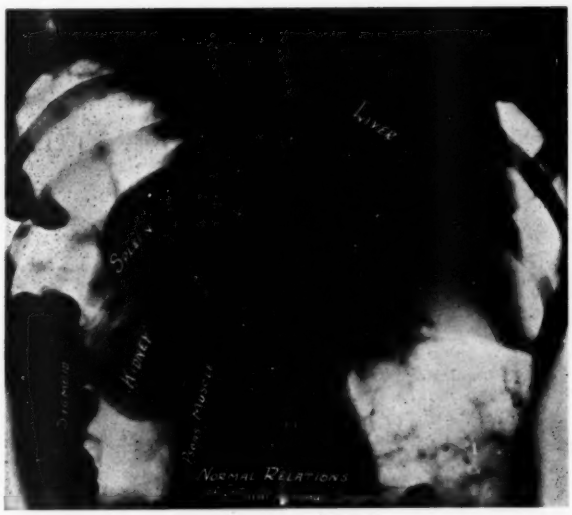

Fig 2.—Normal relations of the intra-abdominal organs in the antero-posterior view.

Figure 4 shows the relation of the female pelvic organs with a retroversion of the uterus. In the male the bladder can be inflated as well, and the prostate demonstrated in a number of instances. Observations on the condition of

the bladder wall are thus also possible.

The second group is well illustrated by the next three plates. Figure 5 shows a large, smooth, rounded mass without attachment to the anterior abdominal wall. Such a plate, however, does not serve to show the connections of the mass, nor will it determine its possible retroperitoneal origin. In order to show whether or not the mass springs from the retroperitoneal structure it is necessary to examine the patient in the retroperitoneal position. This position can be briefly described as follows: the patient is placed in the prone position and supported upon two blocks, one under the thighs and the other beneath the chest. This serves to take all pressure off the abdomen, and allows the abdominal wall to sag freely between the two supports. This position causes the intestines and all intra-abdominal organs with mesenteric attachment to fall forward, leaving the spine and retroperitoneal tissues clearly visible, and producing a prevertebral clear space, which, when encroached upon, shows up any retroperitoneal mass extending into it.

Figure 6 shows this same patient in the retroperitoneal position. It will be seen that the mass drops well forward, leaving the retroperitoneal tissues and prevertebral space uninvolved.

Fig. 3.—Small nodules studding the liver margin, too small to produce definite palpable masses, but none the less definite evidence of carcinomatous involvement.

Figure 7 shows a retroperitoneal carcinoma secondary to a carcinoma of the bladder. In this case it will be seen that the retroperitoneal character of the mass can be easily established. The mass is seen to spring from the retroperitoneal tissues and to extend well into the prevertebral space.

Examination of the kidneys under the conditions indicated in the third group is most satisfactory. Occasionally both kidneys can be shown in the antero-posterior position, but often, especially for the right kidney, a lateral view such as that shown in Figure 8 is

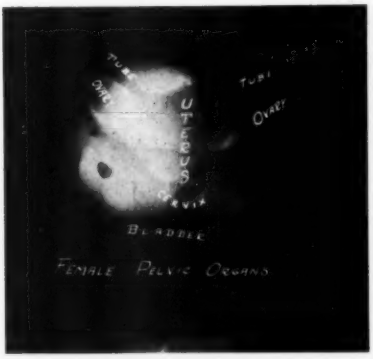

Fig. 4.—Female pelvic organs as seen with retrodisplacement of the uterus.

necessary. The patient is rolled well upon his side, causing the liver to tilt almost beyond the midline. This uncovers the right kidney and brings it well into view. In this position the ureter can be injected and the injected material readily followed under the fluoroscope, showing any kink or obstruction in the ureter. Any shadow suspicious of kidney stone can be readily localized to the kidney in question. The method is also of great value in the detection of other kidney diseases.

In the fourth group the examination of the gallbladder for pathological conditions I feel that this method will ultimately prove a great aid. Its greatest usefulness does not lie in the detection of gall stones, but rather in rendering a pathological gallbladder visible, and thereby localizing shadows suspicious of gall stones to the gallbladder area. Figure 9 shows such a gallbladder filled with stones.

The fifth group where pneumoperitoneum is of advantage is in the detection of abdominal adhesions, postoperative or otherwise. In this connection it is well to remember the regional anatomy on the plate examined so as not to mistake normal structures for abnormal adhesions. The falciform ligament shows well in Figure 10, and might easily be mistaken for an adhesion. Adhesions to an old abdominal scar are seen in the lower abdomen. This method will not aid in determining whether the adhesions present are causing obstruction.

The sixth and last group, that of subdiaphragmatic conditions, such as subdiaphragmatic abscess, is one in which the method is undoubtedly a great aid. Although it has been performed in some cases without injury to the patient, it seems that more extended experience will be necessary before its use in such conditions can be unqualifiedly recommended. Figure 11 shows an extensive adhesion of the spleen to the diaphragm.

This method of grouping is undoubtedly very artificial. The dif-

Fig. 5.—Fibroid of uterus in dorsal position, showing the large tumor mass and distended abdominal wall.

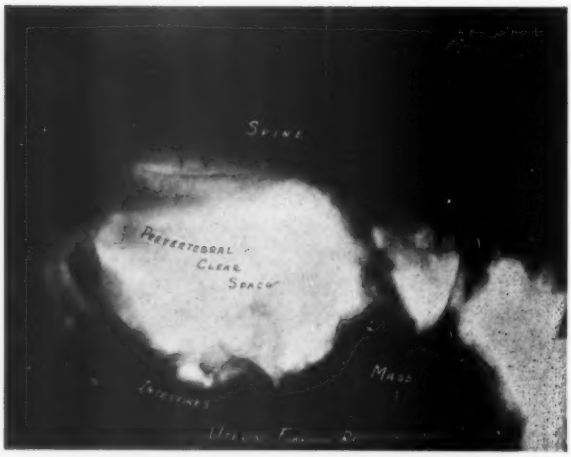

Fig. 6.—Uterine fibroid as seen in the retroperitoneal position, clearly showing the intra-abdominal character of the tumor.

ferent groups may overlap. For instance, a mass of undetermined nature may turn out to be a displaced kidney, or an infected gall-bladder; or a tubercular spleen may be adherant to the abdominal wall. Still it serves as a guide to a clearer understanding of its usefulness.

A brief consideration of the conditions under which pneumoperitoneum was induced in some

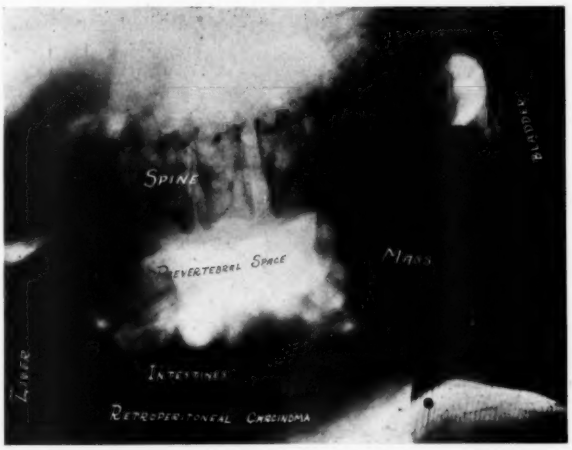

Fig. 7.—Retroperitoneal carcinoma secondary to carcinoma of the bladder shown in the retroperitoneal position.

of our cases, and the presence of other co-existing pathological conditions or diseases, might be of interest. Early in our experience we had difficulty on two occasions on inserting the needle. In both cases the abdominal wall was very thick and the needle was inserted beneath the fascia and the air introduced. In both instances marked subcutaneous emphysema occurred, appearing first on the axilla and side of the neck. Neither patient suffered any ill-effect. Since we have used the apparatus shown, and determined by means of a stethescope when the needle was in the abdominal cavity we have had no further trouble.

We have found that while air takes longer to absorb (5 to 7 days) than oxygen (3 to 4 days), still it certainly causes less pain. In one case of general carcinomatosis the air showed no evidence of absorption and was finally removed on the 12th day. No explanation of the action in this case could be found. One patient on whom no subcutaneous emphysema was induced, complained of obstruction to his breathing from stopping up of his

nose. Examination showed a swollen nasal mucus membrane, evidently due to congestion rather than emphysema.

We have used it in advanced diabetes without ill-effect; mild cardiac lesions, but never when signs of decompensation were present. In general carcinomatosis or tuberculous peritonitis it seems to do no harm and where adhesions are present either postoperative or malignant, no damage has been noted. The lowest blood pressure existing prior to injection in any case in which it was performed was 80 systolic, associated with carcinoma of the head of the pancreas and obstruction of the common duct. The highest blood pressure was 180 systolic, associated with nephritis and slight odema. One patient suffering from chronic pulmonary tuberculosis had a slight pulmonary hemorrhage four days after an oxygen injection. The patient stated, however, that she had had many previous hemorrhages. In one instance pneumoperitoneum was induced in search of a gall-bladder condition, when on operation, a sub-acute appendicial abscess was found. The patient showed no evidence of damage from the procedure. Other than these we have had no ill-effect from pneumoperitoneum.

Fig. 8.—The lateral position necessary to show the right kidney. The patient is rolled upon the side, tilting the liver well over to the midline, thus disclosing the right kidney.

Evidently, therefore, the conditions in which pneumoperitoneum should not be induced can be briefly tabulated:

First. Cardiac lesions with marked decompensation and irregularity.

Second. Advanced cases of nephritis with odema and very high blood pressure.

Fig. 9.—Gallbladder filled with stones.

Third. Acute intra-abdominal lesions.

Fourth. Acute pulmonary lesions, such as pnemonia.

We must remember that the adoption of this method is comparatively recent, and that further improvements in conditions or methods of technique may be found later, which will render this method much more useful. Even, however, if no improvements were made, the method has proven of sufficient usefulness to be firmly established as an addition to the armamentorium of radiological methods. The institution of this method opens up many possibilities for investigation among radiologists, and some of these will be dealt with in a future communication.

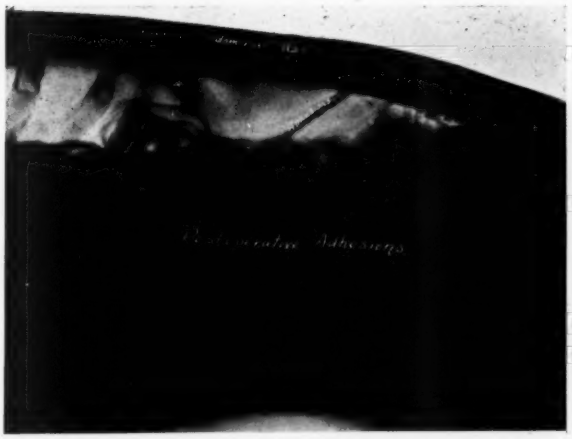

Fig. 10. Post-operative adhesions

Fig. 11.—Spleen adherent to the left diaphragm. Subdiaphragmatic lesions should be easily detected.

*Read at annual meeting of the Radiological Society, Chicago, December, 1920.

Some Points in Radiotherapy in Deep-Seated Cancer

R H. Stevens, M. D., F A. C. P.
Detroit, Mich.

DURING the past five or six years. radiotherapy has compelled respectful recognition from the surgeon. Previous to that time the radiotherapist, in the mind of the surgeon, existed only as a specialist of convenience on whom the hopeless cancer case might be shifted. Today, there is an *entente cordiale* between surgeon and radiotherapist, and they are actually working together, hoping, by their combined efforts. to cure their early and some of their advanced cases of cancer; so that at the present time radiotherapy is being used much more extensively than ever before.

Apparatus

In the past, the manufacturer has devoted practically all his resources to the assistance of the x-ray diagnostician, because the therapists were too few in number to be profitable to him. The result has been but little advance in x-ray therapy apparatus. Consequently, the therapist has been obliged to put up with factory-conceived, and illy-suited apparatus, or construct his own. The time is now here when the manufacturer must listen to the x-ray therapist and build apparatus suited to his needs.

The X-Ray Tube

The Coolidge tube has been, perhaps, the greatest contribution to the development of deep x-ray therapy. When we read, however, of the wonderful work be ing done by the Germans, most of whom are still working with gas tubes, we wonder why we have not made greater progress in therapy in this country than we have. However, the Coolidge tube, elastic and controllable as it is, must be built for higher voltages than the present tubes carry, if we would go on, for there is much evidence that some malignancies may only succumb to large quantities of rays of shorter wave length than any we are yet familiar with in this country.

In the past, we have talked glibly about the cancer cell being sensitive to the x-ray. Our experience with the x-ray and radium rays we are now able to use, teaches us that now we must talk about the cancer cell of this or that type and of this or that stage of development, as being sensitive to a ray of this or that wave length. We shall, no doubt, use filters and apparatus that will enable us to produce any wave length, from the softest x-ray to

the gamma rays of radium, and our problem will then be to get into cancer tissue the proper quantity of rays of the various qualities, which will be suited to the types and stages of development of cellular activity with which we have to deal.

The Transformer

At present, we have transformers which are noisy and cumbersome, but so far as suitable current is concerned, are quite satisfactory. If the Coolidge tube be built, however, to safely carry twice the voltage it does now, transformers, of course, must be built to produce this voltage.

The Overhead Wiring

The overhead system has been greatly improved in the last three or four years, but there is still room for much improvement. The prevention of corona along the main wires overhead, no doubt does away with much of the unpleasant gas that we formerly had, but the trolley reels with small wires and ordinary old-time connections to the tube make a lot of gas, which no doubt helps to make our patients sick. It would seem to be a simple matter to devise practical coronaless reels with ball connections to the tubes, which would effectually do away with corona altogether. The wires leading to the tube should be effectually insulated by hard rubber or micanite for a distance of about 18 inches, so that the patients could not easily come in contact with the high tension current.

Tube Holder and Shield

The tube-stand and holder should be built of wood. The shield should be of some non-conducting x-ray proof material. Heavy lead glass would answer the purpose fairly well, but in therapy there is so much generated for such long periods of time that the glass is likely to crack. The shield should at least extend around the sides and ends of the tube. Many burns have occurred during deep therapy because the ends, particularly the cathode end, were directed toward the patient.

If the whole apparatus is of wood, there will be no chance of grounding a high tension wire with disastrous results. In our laboratory, we have a wooden tube holder which is a diamond-shaped box. It hangs from a wooden arm seven feet long, which runs up and down a two-inch iron standard by means of a counter-weight. The standard is fastened to the floor and ceiling at one end of the treatment room and the arm extends lengthwise over the couch. The box containing the tube is so arranged that it can be tilted in any position. The sides and bottom of the wooden box are lined with heavy lead-rubber and asbestos board, the latter on the inside next to the tube to prevent the heat injuring the rubber. On the other side of the opening in the

floor of the box for the passage of the rays are slots for insertion of a glass cone and filters. The glass cones are made of heavy lead glass of different diameters and of such length as, when placed in contact with the patient, to make the distance between the anode and the skin about eight and one-half inches.

If glass is used as a shield, it should be of deep dark red, green or black, in order to most effectively shut out the glare from the white hot anode of the tube.

These lead glass cones are very convenient in many ways:

1. They enable the operator to work with a constant distance if they are touching the skin.

2. There is no static from them to annoy or burn the patient.

3. One can always see the field of operation.

4. They make the use of lead on the skin, to block out the part to be treated, unnecessary.

The cones we are using are round, having been made by cutting down to proper size the long glass cones put on the market for radiography years ago by the old Scheidel-Western Company. These cones, however, should be square, and of about three sizes, namely 15 cm. by 15 cm.; 10 cm. by 10 cm.; 6 cm. by 6 cm. A small round one, 3 cm. in diameter, would be handy for small superficial lesions.

Filters

We are using both aluminum and glass filters and leather filters. We have not yet tried copper or zinc. In using a ten-inch spark gap with aluminum filters, we were unfortunate enough to puncture several Coolidge tubes, so we changed to glass three or four years ago and have continued using it. In our deep therapy, we use 6 mm. of glass and a piece of sole leather between that and the patient. The glass we use is ordinary 5x7 cleaned Seed x-ray plates. Much of this glass is just 2 mm. in thickness and we use one of these in superficial nodules in and below the skin,—three of them for deep therapy.

Timer With Automatic Switch

A practical timer with automatic switch for x-ray therapy is much to be desired, but there appears to be none on the market. I have had a home-made one constructed which has served the purpose very well for several years. It was described in the American Journal of Roentgenology, Vol. III, 1916, p. 58. It consists of a magnet and armature in circuit with a good wall clock. Its front is a dial similar to a clock, divided into quarter minutes, up to 60 minutes. The clock interrupts the current in the magnet every 15 seconds and the armature connected with a wheel with 240 teeth in its circumference, one for each quarter minute in sixty, is also connected with the hand on the dial, and

moves the hand backward a space corresponding to a quarter minute on the dial. There is an ordinary door-bell ringing coil under the switchboard electrically connected by means of the alternating current from the machine, with a stop at O on the dial. When the hand reaches O, the connection is made with the door-bell ringing coil, which releases a spring, which opens the x-ray switch on the switchboard. Thus we have our treatment safeguarded to a certain extent. Of course, it should be someone's business to watch the treatment just the same, and turn off the current quickly in an emergency. But the human element is not so reliable as many mechanical devices and the two should check one another in such dangerous work as x-ray therapy.

Measurement of Dose

The radiotherapeutic dose at the present time, in this country at least, is only measured by the crudest of methods, which gives but little information. What the future of radiotherapy is, no one can predict because we know so little about dosage. The old pastille and photographic slip methods are wholly unreliable. Most of us using Coolidge tubes are depending upon M. A., K. V., Distance and Time, as the factors concerned. The filter of course, is another important factor. Our individual experiences have settled what the amounts of these factors are. The dose must be considered from three main standpoints:

1. The local effect upon the skin and other normal structures.

2. The effect upon the local pathology.

3. The constitutional effect through the direct action upon the elements of the blood, and through the indirect effect by the formation of toxins from breaking up proteins, etc.

The determination of the numerous physical, chemical and biological factors entering into these actions of the rays will provide an abundance of research work for a long time to come, so that the last word in radiotherapy would appear to be a long way off. Possibly our attention has been too much centered upon the local effect of rays. We have talked about "erythema dose" and "lethal dose" of cancer cells, without giving sufficient consideration to the relationship between these local and the constitutional reactions. The latter, no doubt, has some influence upon the local pathology.

A decade or more has passed since the publications of Barkla and Sadler, concerning the three kinds of secondary rays which are observed when the rays strike substances of the atomic weight of aluminum and higher.

First, there are the "characteristic rays" which have a selective absorption characteristic of the elements from which they arise.

Second, a scattering of the primary beam.

Third, the displacement of electrons from the substance rayed, thus forming cathode rays. These cathode rays lack penetration and are otherwise similar to the less penetrating beta rays of radium.

The characteristic ray is said to be homogeneous though some metals give off two types of characteristic rays which have different absorption coefficients, but still each of a homogeneous type. Copper and zinc appear to give off, under certain hard rays, a most homogeneous type of softer ray, the use of which would seem quite desirable in roentgenotherapy. Consequently, these agents have been used as filters, particularly by the late Prof. Koenig of Freiburg and his associates, half a mm. of copper being used and a current backing up a spark of 40 cm. to 50 cm. Friedrich and Wintz maintain that this characteristic homogeneous radiation was increased by the scattered rays going in the same direction, and this action was increased the wider the port of entry. By means of their Iontoquantiometer — an ionizing chamber, placed on or under a patient or within a cavity—they measure accurately the amount of the dosage at any depth. Startlingly enormous doses thus measured are given through one or two ports until the tumor has received a lethal dose, which latter is carefully determined for different types of growth. Some time later the patient is often given a transfusion to counteract the radiation toxaemia, and the dose is not repeated. Cures of cancer of the pelvis are freely claimed.

The Hamburg School, on the other hand, headed by Albers Schonberg, opposes so radical a method, and uses a more moderate therapy more like that used in this country.

Several investigators, especially Colwell and Russ, have demonstrated that every cell has its own "selective absorption" for rays. This is different, not only for each type of cell, but also for the same types with different functions and the same in different life cycles. The epithelial cell of the hair follicle is more sensitive than that of the epidermis, for instance.

All this clearly indicates that we must experiment with different substances for filters, with different qualities of primary rays from both x-ray and radium, on the various growths with which we have to deal. Radium and x-ray will no doubt both be called into action many times in the same case so as to secure the action of different types of rays on the local pathology.

But we must not focus our attention on the local pathology to the exclusion of the patient himself. The sickness following large doses of x-ray and radium must be a warning to us to watch more closely the patient's general con-

dition as a result of radiation, and let that, as well as the local condition, be a guide to the dose. We require more studies of the blood, both morphologically and chemically, as well as of the various secretions and excretions before and after x-ray therapy, in order to determine just what our dosage should be in a given case.

As I look back upon 17 years of x-ray therapy, and almost as many years since I began radium therapy, and go over the patients with deep-seated cancer, I find only a few who have survived the three-year period and a very few who have gone over the five-year period. To be sure, the greater part of my work has been with operated cases, mostly with recurrences, or inoperable hopelessly advanced cases. Our best results have been with those patients who have had suitable preoperative treatment as well as postoperative, but even in these cases there have been many recurrences. For years I have urged adequate pre-operative treatment, advising two or three series of treatments in cancer of the breast, three weeks apart, before operation. We now have a number of cases so treated but the time is a little too short from which to draw conclusions. It was formerly our practice to give the entire treatment of 12 to 18 ports in two or three days. I am now satisfied that this was wrong and what little chance some of those patients had were lost by lowered resistance as a result of x-ray toxaema. Now we rarely treat more than one or two ports a day, but even these produce a marked nausea and ill-feeling in many patients. The higher voltage, with also higher filtration and consequently longer radiation seems to be responsible. When we were using an eight-inch spark gap with one or two millimeters of aluminum filter, we did not so often have x-ray sickness. We see the same radiation sickness although not so marked, when heavy doses of radium with high filtration are given.

We use radium in combination with x-ray in treatment of cancer of the uterus, but seldom use radium in cases of cancer of the breast. It has a very favorable action on superficial nodules, but we believe these cases will do as well or better under the properly selected x-ray. For a long time we have treated cancer of the breast and recurrent cancer of the chest after breast amputation, by the following formula,—using a large amount of fairly high atomic weight filtration in the form of glass:

8½-inch Focal Distance.

6 mm. of glass and 1 sole leather filter.

5 M. A.

10-inch Spark Gap.

18-20 minutes to each of about 15 ports.

Recently we have had four lung involvements. These were begin-

ning before we began treatment. They were all recurrences after operation for cancer of the breast. The x-ray did not seem to accomplish anything inside the chest, though nodules in the chest wall, axillæ and supraclavicular regions, and, in one case, destructive processes in the fourth and fifth lumbar vertebræ and in two or three ribs (one with fracture), all cleared up. But the lung condition remained and the patient succumbed.

In the fourth case, after trying the above technique and finding my patient was growing worse, I changed my formula to the following:

8½-inch Distance.

2mm. glass, a 1 sole leather filter.

5 M. A.

10-inch Spark Gap.

12 to 14 minutes to about 15 ports.

Stereoscopic plates were made of the chest both before her first treatment and before changing the formula. Both sets of plates show involvement, but in the last plates there was very marked increase in the pathology. She was having increased difficulty in breathing, pain in the chest, was developing much cachexia and was losing in weight, etc. Almost at once, after the change of formula by cutting out four millimeters of glass filtration, her subjective symptomatology began to improve. Her cachexia improved and she appeared better in every way. It is only three weeks since changing our technique so we have not yet made the third set of plates of the lungs. This subjective improvement, however, under the changed formula, suggests that in lung conditions the high filtration may not be desirable.

The longest standing case of deep seated malignancy we have treated with x-ray is one of recurrent post-operative fibrosarcoma of the knee, in a man 21 years of age, referred by Dr. Geo. Augustin, formerly of Detroit. Three prominent pathologists had confirmed the diagnosis, sarcoma of the knee, by microscopical examination. Several prominent surgeons advised amputation at the hip, but he refused. After the second removal and return of growth, we gave him x-ray treatment, beginning treatment in March, 1906. We used a Gundelach gas tube, operated a Scheidel-Western 12-inch coil and mercury interrupter. The spark was about eight inches and there was about one-half to one milliampere of current. He was treated two or three times a week at intervals, from the knee to the liver, for about a year. Six or seven years later, he was allowed to carry life insurance and was alive and well when I heard from him indirectly a few months ago, which is nearly fifteen years since treatment.

About the same time, we treated a man of 70 with a post-operative (for the second time) recurrent fibro-sarcoma of the

thigh, in much the same way. He lived four years without further recurrence and died of some other trouble. This case was also proven by microscopical examination.

In March, 1916, a woman, aged 45, was referred by Dr. C. Kennedy for recurrent postoperative nodule in the left axillary line. The patient had been operated on 11 months previously by Dr. Kennedy, for tumor of the breast. The pathologist's report was round-celled sarcoma. She was given postoperative x-ray treatment as follows:

8-inch Distance.
1 mm. Aluminum filter.
8-inch Spark Gap.
7½ M. A.
7 Minutes.

(Coolidge tube and Wappler transformer) through 15 ports in the chest, all in one sitting. About 18 of these series were given in two years (later in two or three sittings). She refused operation after the first two or three series. The growth disappeared and she is still alive and well, four years after beginning treatment.

A patient, aged 39 years, referred by Dr. Oscar Le Seure, had cancer in the left breast operated upon. Recurrences came rapidly and four operations, including one for removal of the right breast, were done. There were recurrences in three weeks after the last operation. In two months the left hip was involved. Several nodules were present in the skin of the chest and lower part of the back. There were several ribs involved. Stereoscopic radiographs showed no evidence of lung involvement. The patient was terribly emaciated and she was brought to the office in a wheel chair from the car. We began x-ray as follows:

4 Minutes.
8-inch Distance.
7 M. A.
9-inch Spark Gap.

Three mm. Aluminum and sole leather filter, given through several ports of entry to the chest and right hip. She had about 17 such series in 1915 and 1916. She gained rapidly and is alive and well, earning a good living since 1916—four years ago.

A woman, aged 64 years, referred by Dr. H. Hewitt, had the right breast removed for cancer (laboratory confirmation) in 1911; another operation for recurrence in supraclavicular region in October, 1913, and another in October, 1917. She came to me with two nodules in the right supraclavicular region, the size of a walnut, and one in the right axilla. She was given x-ray as follows:

8½-inch Distance.
4 Mm. Glass filter.
5 M. A.
8-inch Spark Gap.

8½ Minutes to 18 ports in three sittings. These series were repeated every three weeks. The nodules quickly disappeared and she has been well for nearly three years.

A woman, aged 73 years, referred by Dr. G. G. Caron, came to me March 7, 1916, with large ulcerated carcinoma of the left breast, adherent to the chest wall and enlarged axillary glands. She had no operation and she was given the following formula:

8½-inch Distance.
1½ Mm. of aluminum filter.
8-inch Spark Gap.
7½ M. A.
9 Minutes through about 12 to 18 ports every three weeks.

Healing was prompt. The last treatment was July 6, 1916, and she has been well ever since—four and a half years.

A woman, aged 50 years, referred by Dr. Shafor, diagnosis: Adeno carcinoma of left breast. Hard irregular nodular tumor in the left breast, firmly adherent to the skin. Several large nodules in the left axilla. She had three series of preoperative treatment, then three postoperative treatments. Her formula was:

8½-inch Distance.
1½ Mm. aluminum filter.
7 M. A.
7½ Spark Gap.
7 Minutes, 22 ports in two sittings, ever three weeks. Her last treatment was in September, 1916. She is alive and well over four years later.

These are a few of the successful cases which would ordinarily be considered hopeless. There have been many deaths. I feel sure that faulty technique is to blame for not saving some of them. They have been treated by different techniques and have not been improved materially. This impresses me with the great importance of making more careful study of the physics and biology concerned for a clearer understanding of radiotherapy. In spite of the long series of 10 to 13, or more, ports treated at one sitting, there was less radiation sickness in cases treated with lower voltages and moderate filtration than with the higher technique, and I am not sure but my results in breast cases treated with less filtration, will compare more favorably than those treated exclusively with much filtration. Now we try to make a combination treatment of moderate and large amount of filtration in chest cases.

In conclusion, let us add that there should be a research committee at work on therapy in this society. It should be composed of physicists, x-ray and radium therapists. First of all, we require better standardized apparatus. The committee should take this up with manufacturers at once, stating the need and securing co-operation. Provision should be made for more research work on the blood and metabolism of cancer patients being treated with x-ray or radium, or both.

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Work To Do

WRITING in eulogium of William Ironside Bruce, late physician to the roentgen ray and electrical departments of the Charing Cross Hospital, and who died from a severe attack of aplastic anemia due to his intense devotion to his work, the London correspondent of The Journal of the American Medical Association says:

> "In view of the dangers to which roentgenologists are exposed, it has been decided to appoint a committee consisting of physicists, physiologists and roentgenologists to investigate—
>
> 1. The changes induced in tissues by the roentgen ray, particularly blood changes.
> 2. The properties of the roentgen ray and the best means of controlling their action.
> 3. To report on the equipment of roentgen ray and electrical departments with a special view to the protective measures employed, and
> 4. Recommendation for the guidance of assistants in those departments, particularly dealing with hours of work and the need for fresh air and change."

After making these comments, he adds the further observation:

> "The progress of roentgenology in this country has been impeded by the want of coördinated research work. It is hoped that money will be subscribed for an institute endowed for research on the physical, technical and biologic sides."

Undoubtedly, every member of The Radiological Society of North America is in thorough accord with this undertaking on the part of our fellow practitioners across the pond. There can be but little, if any room for argument over the need for those things set up for investigation. As there can be but little, if any room for argument that the progress of roentgenologic science has been very greatly retarded because there has been no coördinated attempt to understand and develop all its phases.

That is the primary purpose of societies such as ours. They can have no reasonable excuse for their existence otherwise. Is it asking too much, therefore, when we suggest that this society at its Boston meeting this month take some positive, definite action toward establishing contact and coöperating with the members of the profession in England doing this re-

search work?

And, so that this undertaking, like many other good things, may not dissipate in the shadows of "Everybody's business," we suggest also that this society set aside a sufficient sum of money each year that the committee or bureau to be created shall assume proportions of permanence and be able to function.

State Medicine

THE fact that, in practically every state in which legislative assemblies convened during the past winter, bills fostering the creation of some sort of state medicine were presented for legislative enactment, indicates pretty clearly that this proposition has behind it some well organized agencies, and that the question is of sufficient interest to the medical profession to warrant an intelligent and exhaustive investigation.

It is our own opinion that our present economic flux is the underlying cause for this organized attempt to foist upon the people a scheme of medical paternalism. But it is somewhat suspicious, to say the least, that a program of this kind has not been brought before the public and profession generally and all the facts definitely stated.

Waiving all of these disturbing thoughts, however, let us try to analyze the situation. During the war our own physical unfitness was forced upon our notice commercially, industrially and militarily. The figures compiled by the military authorities alone make us wonder whether our pretensions of physical manhood are not a trifle askew. And when we add to these figures, the unknown quantity of our commercial and industrial physical debility, we have something to conjure with.

But that is not all. We are now passing through the aftermath of the greatest economic struggle history records. Thousands of men and women who represent the dregs of European manhood and womanhood are coming to us as immigrants with their heritage of broken constitutions and filthy, diseased bodies. Encephalitis, typhus, tuberculosis, and the whole catagory of loathsome diseases growing out of the sexual and physical miasma of all great wars, constitute the frankincense and myrrh men and women who can no longer tolerate their own misfortune hold out to us in justification of their pleas for mercy.

With an eye on our own future welfare, the situation is one indeed calling for serious thought and positive action. Whether state medicine will provide the answer to this problem, query? In order that we may not be accused of ignoring the benefits its adherents claim, let us examine carefully a summarization of the seemingly cogent arguments they advance.

1. That the public welfare demands every physician and surgeon have at his disposal a full complement of working tools and sources of knowledge.

2. That the average physician or surgeon does not have sufficient need for all these things to enable or to justify him in their purchase for his own individual use.

3. That the public concern is so real the public can well afford to, and should, provide all these things in order that all physicians, collectively, may have access to them.

4. That by providing a system of guaranteed compensation to all licensed physicians and surgeons from public funds, the profession will be relieved of all questions of a mercenary character and be wholly free to function in accordance with the high ideals to which they all aspire.

5. That the public health is

something which should be safeguarded by community or collective preventive measures and knowledge rather than curative practices.

6. That certain portions of the public will always be unable to provide or indifferent to proper medical care and knowledge for either themselves or their dependents; so that it becomes a question of public policy whether certain recognized public agencies should not be established in order to accomplish publicly and painlessly the things people cannot, or at least do not do for themselves privately. This on the theory that:

(a) Much of our contagious epidemics are incipient with those people who neglect their health in one form or another; and

(b) By providing a common or open sesame for medical treatment and knowledge for rich and poor, young and old, the maimed, the halt, the blind, the desire to be pure in mind and body will fall on the just and the unjust alike —and the "charity" bugaboo exterminated forever so that the profession and the public shall henceforward "lie down together."

7. That since the majority of hospitals are not now successful in a financial way and must depend on public or private contributions in one form or another, all hospitals should be coördinated into one great public organization, administered on a budget basis, and financed by taxation so that the burden of their support will be equitably distributed.

8. That as a member of a particular political or social unit, and having purchased his or her bill of health under compulsion, the average person will be much more apt to seek the personal benefits of that purchase, and thereby provide the impetus to preventive medical science which is so much needed at the present time.

..We have enumerated what seem to us the outstanding arguments indulged openly and insidiously in behalf of state medicine. We have done this for two purposes, the reasons behind which we believe are obvious, that is,

1. To demonstrate that at bottom this agitation is grounded in our economic structure, and can only be solved as an economic problem.

2. To focus our own thoughts on the underlying causes so that we may all proceed in this discussion with a definite picture of the job which confronts us as it is constituted by all the economic, professional and social factors in the order of their importance.

It should be understood in the beginning, we think, that if the medical profession hopes to arrest or eventually obviate the present trend toward state medicine, the medical profession will have to offer some other arrangement which is more practical and socially beneficial. More than that, the medical profession must realize, also, that the mere offering of such an arrangement in theory for public adoption will not be sufficient. The public will have to be "sold" on any plan suggested; and the medical profession will have to do the selling by arduous work, sustained thought, and unbounded patience. Any plan advanced will have to be reduced to terms of public expression and demonstrated in actuality with sufficient frequency to convince even the most stubborn adherent of the socialistic idea of state medicine.

We appreciate that it is futile to hope for any majority concert of professional opinion on such an important

question without full discussion. Perhaps there may be an overwhelming majority of medical men who would not be averse to becoming attached to a government payroll. Probably there will be numerous others who will feel that the scheme of state medicine is worth a trial—the public health considered.

Frankly, we do not incline to either view. And, while we do not question the right of the people, through the police powers of the state or other political subdivision of government, to adopt and enforce such regulations as will best safeguard the public health, still we do contend that the public pensioning or subsidizing of the medical profession in any form will not provide the relief sought. The fallacy of that principle, it seems to us, has been pretty thoroughly demonstrated during the past few years in business undertakings of one kind and another—a demonstration which has added a good many millions of dollars to the public debt without commensurate, or, in fact, any real benefits.

The Patients' Interests

BECAUSE of the importance of our immigration problem from a physico-medical standpoint, especially at the present time, we want to call the attention of the medical profession to the other half of the profound truth uttered by Dr. James B. Herrick of Chicago before the annual conference on Medical Education and Hospitals, Licensure and Public Health at Chicago on March 7th. when he said:

> "I wish at the outset to advance the yroposition that in any discussion of the relation between specialist and general practitioner there is a third party to be considered, namely, the patient. Furthermore, his rights take precedence over those of the other two parties."

Dr. Herrick's subject was "Relation Between the Specialist and the Practitioner," and his address is printed at length in The Journal of the American Medical Association of April 9th, 1921.

Speaking as he was before a body of medical men, and himself a member of that group, it was perhaps but the natural thing for Dr. Herrick to presume that his auditors were fully versed in the rights of the patient as between him and the general practitioner, and to talk to his hearers more particularly about the new aspect injected into this situation by the entrance of the third party, the specialist. All well and good. We have no quarrel with Dr. Herrick.

But the question which to us seems to need further discussion and definition, at least in the minds of a great majority of us who plod along day after day as best we can, is, what consideration is to be given the patient, speaking generally, and just what are his rights, speaking specifically?

It occurs to us that it is somewhat difficult to keep within the bounds of patient interest or patient rights in our personal conduct unless we know pretty thoroughly just what the patient's interests and rights are, and as exactly as possible what one engaged in the practice of medicine or surgery or any specialty must do in order to merge his activities and his knowledge with patient interest and patient rights.

Perhaps we may be accused of being bumptious. Indeed, it is too obvious for discussion that every medical man knows what the patient's interests are and if he runs afoul of patient's rights he can employ a lawyer.

However, that is not in accord with either the spirit or letter of the law of the medical profession. There is a nice distinction between legal rights, by which most men measure their conduct, and the moral and professional obligation which abides with

medical men to the end that patient interest shall be fully subserved in all cases as far as humanly possible. Patient interest and patient rights are two very distinct things.

Personally, we think this matter of such importance as to merit the earnest study of the profession. This study to be effective involves frank discussion pro and con in order that certain fundamental principles shall be carefully set up for the guidance of men who find themselves too pre-occupied with daily duties to think the proposition through, and who as a consequence dispose of each patient in the easiest way as mater of self-preservation.

There is no thought of professional malfeasance in this statement. But there is a very keen appreciation for the fact that medical men are human, and that in the actual application of their knowledge and energies they suffer the usual human limitations.

Under the pronounced motility with which human affairs proceed nowadays, the interests of the individual patient may reasonably be expected to change with equal rapidity. Certainly, it cannot be assumed that the patient's interests are static, and that a rule of conduct prescribed a few hundred years ago meets the requirements of the situation today, or that the rule of today will be the absolute rule of tomorrow. As a matter of fact, it is doubtful whether any hard and fast methods can be concocted which will guarantee to either patient or profession the absolutism of a sine qua non. To sacrifice dignity of expression for perfect understanding, we feel that discussion of this problem should be constant and searching, to the end that the individual practitioner may, like the good old house cat, always light on his feet.

Quite naturally, such an effort presupposes a broad and comprehensive plan of procedure. In order to succeed that plan would necessarily have to embrace many points of contact with and knowledge of practically every human activity. But why not? Is such a thing impossible?

We think not. There is no more honored body of men anywhere than the medical profession. There is no more studious or thoughtful class of men. None other comes into more intimate relation with all the people. Therefore, their opportunity for constructive leadership in social and in economic affairs as they touch private and public wellbeing is professedly obvious and real.

We believe we speak the desires of Radiologists everywhere when we say that it is their high purpose to pull a laboring oar in any movement that will be of benefit to medical science and medical men. They are perhaps peculiarly qualified to discuss the quesions pointed out because in a very large way they act as specialist consultant.

It may be too, that Radiologists have just a little bit of an edge on most other branches of the profession in what may be termed business experience, a very vital thing in the successful disposition of questions pertaining to public relations. Radiologists as a class must mainain very large plant investments as compared with either the general practitioner or other specialists, and must necessarily give considerable thought to hour cost of operation, scientific management, etc., questions too often considered "of business—too busy."

In view of all which the suggestion seems pertinent that here is an important section of the general professional plan where the Radiologists may serve faithfully and valuably in conjunction with the exposition of the scientific side of their relationship to the profession and the public.

Dividing Mass Dosage

UNDER the stress of producing results, in deep therapy especially, where the opportunity and the need are so great, and knowledge and specific technique are so small in comparison, the Radiologist is too apt to err on the side of over-dosage rather than under-dosage. This is particularly true in malignant growths where the dosage must be heavy if first reactions produce those tissue changes which make later treatments effective.

The Radiologist very often finds himself between the two horns of a dilemma—whether to get results ad nauseum or to run the risk of failing to function in order to avoid acute discomfort on the part of the patient.

Talking with Dr. E. C. Ernst of St. Louis not long ago, he told us he was dividing mass dosage into two smaller doses, the second but a few days removed from the first in point of time, in an effort to find a happy medium on this proposition if possible. While his experiments have not yet been extensive enough to justify a sweeping assertion as to their ultimate value, Dr. Ernst is very much gratified over the results thus far obtained.

There are, of course, certain cases where a division of dosage is neither advisable nor possible, but these may be set aside as emergency cases.

It is not our purpose here to discuss technique. That will come in due time when adequate knowledge, supported by case histories, has been acquired. Then we shall have something of scientific value for the profession.

In the meantime, however, we should be concerned with this opportunity to give the public tangible manifestation of our high professional conception of patient interest. And as we proceed in future, we should keep this problem graven on our minds in letters of fire, because when we shall have devised a method of dividing mass dosage without sacrificing results we shall have gone a long ways indeed toward the popularization of high voltage massive x-ray therapy.

Perhaps a good many of the better thinkers among the Radiologists have been working along this line for some time without saying anything about it. In other words, they have probably been proceeding on the theory that "silence is golden" until they could say something definitely good about their efforts.

But this is hardly the correct view. We feel there should be no hesitation in speaking openly about a theory of this kind which is certainly correct in principle, and which, if we understand the progressive scientific spirit of the Radiological profession will eventually be proven right in practice.

There can be no serious dispute over the proposition that the line between over and under-disage is a very delicate and inconstant thing. Each patient presents for consideration a differently gradated power of resistance, and each malignancy also sets up a varying factor depending on kind, age of patient, stage of development, etc. We must be fully conscious of all these elements which are not subject to exact precision.

But there are certain guiding principles in this matter which should be discovered and evaluated. With these things known, every Radiologist worthy his profession will be able to give that greater individual care and study which will relieve his ministrations of needless inhumanities.

Correspondence

Dear Editor:—

I note in the "Department of Technique" of the Journal of Radiology, that the expressions "Antero-posterior" and "Lateral positions" are repeatedly used in reference to the wrist.

At the St. Louis meeting of The Western Roentgen Society in 1916, I called attention to the lack of anatomic accuracy of these expressions when applied to the hand and wrist, and want to again object to the use of the inaccurate and vague, when we have amply terse and definite terms which fit better and cannot be mistaken in their meaning.

In discussing this subject with surgeons, some have held that the radio-ulnar direction through the wrist joint was the antero-posterior direction, while others consider that the dorso-palmar direction is the antero-posterior. This inaccurate way of description has always to be qualified, whereas if we used only the strictly anatomic method of describing our technique, etc., apologies and amplification would be unnecessary.

We should always refer to the radio-ulnar and dorso-palmar directions in the hand and wrist and the tibio-fibular and antero-posterior directions in the knee or leg. This is particularly necessary nowadays when so many of us are using duplitized films, which may be interpreted as either right or left (aside from markings to prove otherwise.)

Those of the readers of this who know me, know that precision has long been my watchword. I am a crank on it, and I am proud of it.

Sincerely,

I. S. TROSTLER.

Department of Technique

A Modification of Technic For Radiographing Upper Molars

By C. A. LeMASTER, D. D. S.,
St. Louis, Mo.

JUST two factors enter into the production of a dental radiogram: Proper technic, including exposure and development, and correct angle. While the first will be subject to the personal views and preferences of the individual roentgenologist, and may vary within considerable limits without in any manner impairing the diagnostic value of the radiogram, the latter, that is the angle of incident of the Roentgen rays in relation to the film and tooth, may not vary in the least without seriously detracting from the value of the radiogram.

The well-known law which governs this may be concisely stated: The

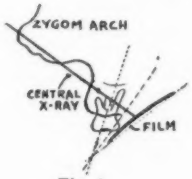


Fig. 1

Fig. 2

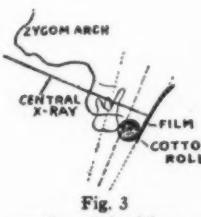


Fig. 3

Fig. 4

angle of incident of the normal ray shall strike at right angle the plane which exactly bisects the angle formed between tooth and film—a law to which there is no exception.

In considering this rule, we readily learn the reason which renders the making of a radiogram of the upper molar area exceedingly difficult at times; namely, the shadow of the zygomatic arch and the lower margin of the maxillary sinus are often projected over the molar roots, a situation which occurs with annoying perversity precisely in those cases where a clear image of those roots is very important. Figures 1 and 2 illustrate this.

Various measures have been suggested to overcome this difficulty, all of which may be classified under one group—the deliberate producing of distortion, in such a manner as to throw the suspected area clear from these shadows. This, to be sure, will often furnish a radiogram of sufficient diagnostic value, but unfortunately the relation of the various structures of the tooth appear at times distorted to a confusing extent. Rather than do this a radiogram is very frequently taken in normal position, and just as frequently some important diagnostic features are entirely overlooked.

Bacterial Fog

IN a recent visit to a neighboring radiologist, we were shown some plates which had many small black spots scattered over them. This called to our attention the fact that very little publicity had been given to this kind of fog.

These black spots are characterized by being small and round blackened spots, occurring in various locations through the plate, the center of each spot being very dense and gradually fading out at the circumference. Upon closer observation, especially if a magnifying lens is used, it will be seen that these spots are made up of many small radiating lines, being more closely assembled toward the center

from which the lines radiate outward like the spokes of a wheel.

This kind of fog on the plate is due to the fact that in the process of manufacture the gelatin used for making the emulsion was not cooked sufficiently to kill all of the spores contained in the gelatin. After the emulsion had been coated on the plate, these spores slowly developed into living bacteria. These bacteria are of the aerobic type and slowly oxidize the silver of the emulsion found in their vicinity. Of course, this oxidization has the same effect on the silver as though it were exposed to light, so after the plate is developed these intense black spots show distinctly, interfering with the image cast upon the plate at the time of the examination.

A New Method Of Illumination for Plates and Films

J. DéVOINE GUYOT, M. D.
Bucklin, Mo.

I WISH to present to the profession a new method that I have found extremely useful in soft tissue work, and with plates and films that are flat and lacking in detail.. It is also very useful in all classes of dental work.

Load an unexposed plate in a cachet or other holder, carry it into the sunlight and expose it to the direct rays of the sun for several minutes.. Do not. use. the. sunlight. that. passes through the window glass or wire screen, and be careful to expose the whole plate at once, otherwise it will be mottled.

After the plate has been exposed to the direct sunlight, put it away in an even subdued light, being careful that there are no shadows cast on it by objects close to it.

Allow it to remain several days in this light; this is the seasoning process, and the emulsion should present a sea green color.

The plate is now used exactly as the ground or opalescent glass of the ordinary illuminating boxes, but you will be surprised how much more detail it will put in your plate or film.

When using, put the emulsion side of the plate or film next to the emulsion side of the screen plate, and for dental films a useful procedure is to use a plain glass to cover over the films after they have been placed in position. They can then be examined before any ordinary electric light.

Plates that, under ordinary form of illumination, are so thin and flat as to be useless, frequently become good working plates when examined by this method.

In a recent case, which was the basis of a legal procedure, the radiograph which was obtained at the time of the accident was so flat as to be useless.. By the use of this method, it showed detail enough to be easily read.. As this was the only plate that could be obtained it was very important.. No doubt such occasions will often arise, or the patient may live at a distance and another exposure obviated.

I related the method to Dr. H. J. Ravold of St. Joseph, Mo., at a recent meeting and he has since written me that he is enthusiastic regarding its use, in the type of plate and film suggested.

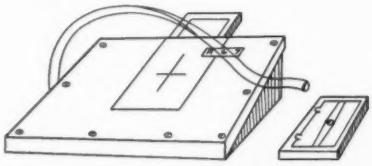
Of course, the perfect plate or film does not require this method of illumination, nor is it desirable in a very dense plate but in its field, I believe it superior to anything now in use. It is at least worth trying, and the expense of making is but a trifle.

I commend it to your consideration.

A Simple Device of Mastoid Radiography

J. H. Dempster, M. D., F. A. C. P.
Detroit, Mich.

THIS consists of a block of wood 16x10x1¼-inch supported at each end by cross pieces, which give the proper angle for mastoid work, chiseled out so as to admit a cassette namely twenty-three degrees from the horizontal. The face of the block is 6x8 inches, which size is sufficient to permit of easy insertion of a cassette capable of taking a 5x7-inch duplitized film. The block is faced with sheet aluminum one millimeter in thickness and on it are drawn lines indicating the position of the film within the cassette.



In the upper right hand corner there is a rotating marker with the letters L and R. The patient's head is placed in position with the mastoid being radiographed centered over the cassette with the penna of the ear drawn forward.

The head is immobilized by means of a piece of gauze or cotton bandage attached as indicated in the device. When the right mastoid is being taken the marker is rotated so as to bring the letter R over the upper right hand corner of the plate and the patient's head is turned to the opposite side with the ear drawn forward and immobilized by roller bandage fastened over the upper mastoid region. In making a radiograph of the left mastoid, the head is reversed and the markers rotated so that the letter L replaces the R. The position of the letters R and L facilitates the orientation of the film for reading.

A pair of double screen cassettes capable of handling 5x7 duplitized films are used. The exposure is much shortened as compared with doing the work without screens. The following technic works well with average adults: five seconds exposure; four-inch spark gap; twenty-five milliampere current; twenty-four inch distance, or a compression cone may be used.

The radiographs are made with a vertical central ray centered over the central portion of the plate as indicated by the cross in the drawing. This device lends itself admirably to stereoscopic work. There is a further advantage that the radiographer is able to furnish the aurist along with his typewritten report a pair of films showing the mastoid under examination, likewise the opposite mastoid for comparison. It is possible to obtain a screen with a grain so fine as to be practically a negligible factor.

Abstracts and Reviews

The purpose of this department is to furnish its readers a succinct epitome of current interesting articles and books. We will be glad to review articles which have been presented for publication or any manuscript or book sent us.

Roentgen Ray Studies of Bronchial Function, by J. G. M. Bullowa, M. D., and Charles Gottlieb, M. D., New York. Am. Jr. Med. Sci., July, 1920, p. 98.

CREDIT for the early use of bismuth in injecting bronchi and lung cavities for clinical study must be given by this admirable work done upon dogs. The following observations were recorded by the authors:

1. If the left diaphragmatic bronchus and its branches are injected, it is seen to move laterally with each pulsation of the heart.
2. A peristaltic action of the bronchial muscles, which seems adequate to empty them without invoking ciliary movement.
3. The action of adrenalin, benzyl, benzoate, ether and muscarin have been observed by this roentgen ray method.

Attention is called to an abstract of an article in the April issue of this Journal. Drs. Lynch and Stewart of New York City published some excellent studies on the human living being covering these same points and going farther at least in the clinical adaptation of this method of study. By priority of publication Dr. Bullowa's work antedates this one, and historical accuracy at least justifies us in giving him credit for this one observation before Drs. Lynch and Stewart.

—E. W. ROWE.

The Use of Agar-Agar in Gastro- Intestinal Roentgen Ray Work. John Tucker, M. D., Cleveland. Jour, A. M. A., April 16, 1921.

ROENTGEN RAY clinics have universally adopted buttermilk as a vehicle for bismuth or barium salts in gastro-intestinal work. The difficulties are (1) expense, (2) inaccessibility, and (3) need of refrigeration. From a physical standpoint other vehicles are better. Certain colloids are far preferable. Agar-Agar is the most convenient. It has been tried out in the Department of Health of the B. F. Goodrich Co., of Akron. A 0.4 per cent solution of the powdered, flake or shredded laboratory agar-agar in filtered water made a colloidal vehicle of almost satisfactory consistency.

The method of preparation is simple. To a 2-liter flash containing 1,000 c.c. of filtered water (plus 10 c.c. to allow for evaporation) are added 4 gm. of agar- agar. A cotton plug is used as a stopper, and the water is boiled until all agar-agar is dissolved. This takes five to ten minutes. The flask is then put in a cool or cold place, and within six hours is ready for use. For stock, several flasks of the solution should be prepared at the same time.

The amount used varies with the thickness of the patient. From 350 to 400 c.c. of the agar-agar and 180 to 250 gm. of chemically pure barium sulphate is average.

ADVANTAGES—

1. Ease in preparation.
2. Stable qualities (the solution is sterile.)
3. Uniformity of suspension.
4. Lack of gastric symptoms after ingestion.
5. Lack of expense.
6. Clarity of shadow of fluoroscope or roentgen ray plates.

—E. W. ROWE.

Roentgen Ray Treatment of Cutaneous Cancer. H. H. Hazen, M. D., Washington, D. C. Journal A. M. A., April 30, 1921.

THIS is an attempt to show what has been done. The value of this therapeutic agent has been overstated by its friends. However, some do not properly estimate its value. This report is founded on observations on private cases. About half have been followed with the microscope.

The most important are the prickle-cell and basal-cell growths. The for-

mer tend to form metastases and the latter do not. Pathologically the prickle-cell cancer consists of large cells that take acid stain with avidity, and there are always epithelial whorls present. In basal cell growths the infiltration is less deep, the alveoli are smaller, the cancer cells are smaller and take a basic dye; in addition, no epithelial whorls are present.

Sarcoma, malignant moles, and xeroderma pigmentosum have been successfully treated. The majority of the cases, however, are either basal-cell or prickle-cell cancer.

Of the basal cell cancers, 147 were treated. Sixty-one were men and forty-three women. In seventy-seven the cancer sprang from keratoses, in eleven from congenital warts or fibroepitheliomas, in three from pigmented moles, in six from constant slight trauma.

TABLE I.—Results of Treatment.

	Number Cases
Well 3 years	16
Well 2 years	17
Well 1 year	39
	72
Relapses cured	4
Relapses healed	2
Healed	41
Not cured	16

A study of the cases shows that neither the age nor the sex had any bearing on the result.

TABLE II.—Results of Treatment on Various Types of Lesion.

Type	Total	Well	Healed	Recurrence Healed	Failed
Superficial plaque	5	5	..	..	..
Rolled edge	80	44	22	2	7
Deep ulcer	9	1	..	1	4
Superficial nodule	28	12	12	1	..
Deep plaque or nodule	22	9	5	2	5
Morphia-like	1	1	..	..	..
Cicatrizing	2	..	2	..	..

Basal cell cancers on the eyelids and the ears, where cartilage is involved, have notably resisted treatment.

TABLE III.—Location of Growths and Effect of Treatment.

Location	No.	Recurrences Cured	Recurrences Healed	Cases Healed	Failures	Total
Scalp	1	..	..	0	0	1
Forehead	4	..	..	1	1	6
Left Temple	6	..	..	2	0	9
Right Temple	1	..	..	4	2	7
Right outer canthus	1	..	..	1	0	2
Left outer canthus	1	..	..	2	0	5
Right inner canthus	3	1	..	3	1	8
Left inner canthus	0	..	..	1	0	1
Nose	14	1	..	10	1	27
Right nasal fold (facial)	2	..	..	1	1	4
Left nasal fold (facial)	2	..	1	0	1	4
Right nasal labial fold	0	..	..	1	1	1
Left nasal labial fold	0	..	1	1	1	4
Upper lip	2	..	..	0	1	3
Lower lip	0	..	..	0	1	1
Right cheek	5	..	..	7	1	16
Left cheek	12	..	..	3	1	18
Chin	4	..	..	0	0	4
Right neck	4	..	..	1	0	5
Left neck	4	1	..	0	0	7
Back	2	..	..	0	0	3
Chest	1	..	..	0	0	1
Hand	3	..	..	0	0	2
Elbow	1	..	..	0	0	1
Left ear	0	..	..	12	1	4
Right ear	0	..	..	1	2	3
	72	3	2	41	16	147

TABLE IV.—Results with no treatment, and with various types of treatment.

No. of Cases —	Cures	Healed	Relapses Healed	Failures
No treatment	52	34	3	7
Excised	5	1	..	0
Cautery	3	2	..	1
Roentgen ray	3	1	2	6
Radium	4	3	1	2
	67	41	6	16

Table V.—Number of Treatments Required to Heal Lesions.

Type of Lesion—	Treatments— 1	2	3	4	5	6	Many
Superficial plague	2	3	..	..	..	..	..
Rolled edge	3	37	17	4	2	..	2
Deep ulcer	..	..	1	1	..	..	..
Superficial nodule	2	3	15	4	..	..	..
Deep nodule	1	4	2	1	4	3	..
Morphia-like	..	1	0	..	..	..	..
Cicatrizing	..	..	2	..	..	..	..
	8	48	37	10	6	3	2

Fifteen patients with prickle-cell cancer were treated. Three originated from keratoses, two from scars and two from undiagnosed dermatoses. Four were permanently cured; three healed under treatment, although it is too early to say the patients are well; and eight were not in the slightest degree influenced.

The Question of Dosage

In practice, if the first dose has no beneficial effect, the second dose is always made considerable heavier.

The Question of Filtration

No filters is best.

Outlook for the Future

Heavier apparatus not of benefit to superficial cancers.

Cosmetic Effects

Excellent. Fifteen cases with slight telangiectosia.

Comparison of Methods

The treatment of basal-cell cancer with carbon-dioxide snow, the electric needle, spuerficial curettage and burning with superficial caustics, is mentioned only to be condemned. A skilled surgeon can operate and give excellent results, but a less skilled surgeon cannot equal the roentgenologists. Surgery clears it up rapidly, but often does not remove enough.

There is every reason to believe that the action of radium is the same as the roentgen ray. The five treated that refused to heal also refused to yield when radium was used.

—E. W. ROWE.

A New Intestinal Tube, with Remarks On Its Use In a Case of Ulcerative Colitis. Max Einhorn, New York. American Jour. of Med. Sci., p. 546.

DR. EMHORN has been using a long-jointed tube that passes entirely through the intestinal tract. It is fifteen to twenty feet long and 8 mm. in circumference. The end of it is the usual duodenal tube with a metal fitting and thread. Aspiration is possible only at 1 and 2 meter lengths. The tube is entered a section at a time, and additional lengths are screwed on. It can be fed in by the touch or the roentgen ray to guide it. It is well borne. It permitted the lavage and necessary treatment in a case of ulcerative colitis and eliminated an operation. Perforation of the intestine is not likely.

—E. W. ROWE.

Keen's Surgery. W. B. Saunders Co., Pubr. Vol. VIII.

THIS supplementary volume to Keen's "Surgery" has recently been received. In general it may be said that it gathers up the loose ends of an advanced field in science. Surgery has many new chapters developing. This book in a remarkable way has surveyed the recent contributions to the specialty, and has col-

lected a series of monograms on the latest subjects and new problems. It will be eagerly read by those interested in that which is fast becoming standard.

There are two chapters which will interest the roentgenologist. (1) Chapter LIV, "Radium in the Treatment of Malignant and Other Diseases," by William Duane, A. M., M. D., and Robert B. Greenough, A. B., M. D., Boston. (2) "The Technical and Clinical Use of the X-Ray," by Lewis Gregory Cole, M. D., and Joseph M. Steiner, M. D., New York.

The first chapter is an able review of the laws and principles of radio-activity, methods of treatment, methods of estimating doses, etc., to gether with a second part aiming to cover the field of radiotherapy. The following general summary by the author will give insight into the value of the article.

1. In the treatment of carcinoma the destructive action of radium rays on cancer tissue is beyond dispute. If the cancer tissue is superficial and not of too great extent it can be locally destroyed.

2. If the disease has already extended by infiltration or by metastasis to the deeper tissues, the effects of deep radiation are rarely if ever curative.

3. A differential action of radium on cancer tissue, such that the carcinoma cells are destroyed without any destruction of the stroma or of the surrounding healthy tissues, is still a matter of discussion.

4. The radical cure of cancer demands the removal or destruction of the local point of origin of the disease, together with the tissues known to be first involved by infiltration or metastasis.

5. Radium can in some instances produce the local destruction of the primary tumor, but must be supplemented by operation upon the regional area of metastasis if a radical cure is to be obtained in any case where metastasis has taken place.

6. Since radium treatment is not painful and does not confine the patient to a hospital, it can be applied promptly for suspicious but doubtful lesions, where operation would not be justified.

7. In cancer in certain locations, where radical operation has yielded unsatisfactory results, as in cancer of the cervix of the uterus and cancer of the tongue and mouth, the destruction of the local lesion by radium, supplemented in certain cases by the surgical removal of the regional lymphatics, offers advantages which may yet prove superior to purely operative treatment.

8. Tumors other than carcinoma show varying susceptibility to radiotherapy. Certain types of sarcoma, lymphosarcoma, the teratomata, ovarian and testicular tumors, and the mixed tumors of the salivary glands, all appear to be affected favorably by radium when direct application can be made. When deeply placed these effects are not so evident.

9. The non-malignant hypertrophic diseases of the skin and mucous membranes—the keratoses, papillomas, leukoplakia, keloid and nevi—are favorably influenced by radiotherapy. In many cases a brief and mild treatment definitely destroys the lesion. In some inflammatory conditions also (eczema, lupus) favorable results are obtained. In many other skin diseases radiotherapy has been attempted without conclusive results.

10. In gynecologic practice radium has proved of the greatest value in the treatment of uterine fibroids, certain types of uterine hemorrhages, rysmenorrhea, endometritis, kraurosis vulvae, and urethral caruncle.

11. The value of radiotherapy in leukemia and other blood diseases and in malignant lymphoma or Hodgkin's disease is beyond question. Although the benefits are often temporary, the improvement is apparently more marked than with other methods of treatment.

12. The medicinal use of radium and radio-active substances, as in drinking water, is not yet established on reliable grounds. The amount of radio-activity thus obtained would appear to be of infinitesimal value.

The chapter dealing with x-ray covers very well the gastro-intestinal tract. The briefest mention is made of other important systems of the body. Practically nothing is said of x-ray therapy.

One point is of interest. Writers of surgery are calling more and more on authorities in roentgenology for expert knowledge in the specialty. No longer does a careful surgeon try to

make his own summary and deductions of all that is worth while in a branch that has grown beyond his knowledge or experience.

—E. W. ROWE.

Physiological Action of and Therapeutic Indication for the X-Rays. Dr. J. H. Dempster, M. D., F. A. C. P., Detroit, Michigan. J. Michigan State Medical Society, April, 1921.

A BRIEF HISTORY of the development of modern deep therapy is considered after which the author takes up a discussion of the effect of the x-rays on the tissues, mentioning not only the histological changes occurring, but also the important part played by ionization of the tissues.

He makes the statement that the effect of x-rays upon the living cell is first, stimulation; second, inhibition, and third, destruction. The destructive action is the one depended upon in the treatment of malignant new growths.

Brief mention is made of the recent technique brought out by the German radiologists, but in describing this the author has neglected to state the difference in the method of measuring the voltages in Gerany as compared with the method employed in America. This leads one to think that the German technique is much more advanced over the American technique than the actual facts prove.

A brief discussion is given of the effect of the x-rays and radium upon different conditions which are amenable to treatment, including radiation treatment of enlarged tonsils.

1. The x-rays may be used with stimulating, inhibiting or destructive effect at will of the x-ray therapist.
2. Their physiological action depends upon their ionizing properties.
3. Malignant cells resemble embryonic cells so far as being effected by the x-rays and radium is concerned. The destructive effect of these agents depends largely upon the power to produce an olbiterative endarteritis.
4. The x-rays have a large field of usefulness in pre-operative and post-operative treatment of malignancy.
5. Among the pathological conditions, which respond favorably to x-ray therapy, may be mentioned; Uterine fibroids, especially the subserous and submucous type, uterine hemorrhages, leukemias, hyperthyroidism, tuberculous adenitis, epitheliomias and various dermatoses.
6. X-ray dosage has been recommended as pre-operative measure in increasing the coagulability of the blood and in reducing the metabolic rate in thyroid cases, thereby rendering them good operative risks.
7. The x-rays have been employed with success in reducing hypertrophied tonsils.

—A. F. TYLER, M. D.

Diagnostic Experience with Artificial Pneumoperitoneum. Faschingbauer, H. and Eisler, F. Wiener Klinische Wochenschrift, 1920, xxxiii, 853.

GAS INFLATION of the abdomen as a diagnostic aid was first carried out by Weber, Lorey, Meyer-Betz, and Rautenberg. Rautenberg's work was confined to cases of ascites in which he supplanted the extracted fluid with oxygen. Goetze, who has done much to perfect the technique of the method, was the first to subject his technic to surgical tests.

Although the Viennese hospitals were rather conservative in taking up gas inflation, they now, as a result of considerable experience, have adopted a definite technique.

For several days prior to the examination the intestines are kept well evacuated; no food is given on the day of examination and immediately before the examination the patient is directed to empty his bladder. A subcutaneous injection of morphine is given and the patient is placed on an x-ray table which can be tipped to any angle. He is then screened in the dorsal position to ascertain the amount of gas in the gastrointestinal tract. Unless contraindicated by adhesions the site of election for inflation is about 3cm. below the navel and through the center of the right or left rectus muscle. The solidity of the muscle at this site insures a good closure after withdrawal of the needle. Under local anesthesia a fine, sharp-pointed, injection needle 8 cm. long is passed through the muscle. On reaching the posterior sheath, which is determined by the increased resistance, the needle is connected with a Franck's pneumothorax apparatus which injects the gas under a pressure of 300 cm. of water. The rectus sheath and peritoneum are pierced and the gas is allowed to enter the peritoneal cavity under observation with the fluoroscope.

From 1.5 to 3.1 liters are insufflated according to the size of the cavity, the tenseness of the abdominal walls, and the sensitiveness of the patient. The needle is then removed. After the screen examination a slightly large needle is introduced under screen control and the greater part of the oxygen is allowed to escape. Leaving the gas in the cavity causes the patient considerable discomfort. Spontaneous resorption does not take place under four to six days, and in some cases not before several weeks.

Occasionally a slight increase in temperature was noticed and in two cases a cutaneous emphysema resulted from the puncture. There is practically no danger of gas embolism or infection if the author's technique is followed. Injury to the intestines at the site of adhesions is hardly possible if the insertion is made under screen control.

Insufflation is contraindicated in patients with acute inflammatory conditions of the peritoneum and in diseases where an increase of the intra-abdominal pressure is undesirable.

The patient should be screened in various positions. First, with the head high and low; second and third, the left and right lateral positions with the same variations. The transition from one position to the other must be made slowly with continuous roentgenocopy; special attention is paid to the various changes in form and position of the organ. Fourth, knee chest position, right-left and left-right. Fifth, standing position.

By way of contrast the stomach is often distended with effervescent powder and the colon by insufflation. Various difficulties arise in the interpretation of the x-ray picture. The organs following the law of gravity and their own elasticity often manifest changes in shape and position which make it difficult to distinguish between the normal and pathologic.

Gas dilatation of the stomach and colon gives an unusual view of the liver, especially of the diaphragmatic surface. Its size and form are best judged with the patient upright. The right lobe is made out most clearly in the dorsal, left diagonal, upright position. If there are no adhesions, the organ is separated from the abdominal wall and diaphragm. The smooth surface of the normal liver is shown by very distinct shadow boundaries. The liver is very pliable and often as a result of increased intra-abdominal pressure may give appearances suggesting pathologic conditions. An increase in size is readily made out and if there is an increase in the consistency of the organ this is expressed by a loss of the normal changes in shape; the upper surfaces retain their convexity.

Insufflation is of more advantage from the diagnostic point of view in conditions difficult to recognize clinically, such as atrophic diseases of the liver. In atrophic cirrhosis the finely uneven surface of the liver causes the normally distinct margin of the liver shadow to become blurred. If a diseased focus is near the surface of the liver, a definite aid to diagnosis is obtained. This is of unusual importance in the search for metastatic growths. Abdominal inflation offers no special advantage in diagnosing diseased condition of the gallbladder.

The spleen can readily be made out; the notch, the smooth posterior margin, and the hilus are not infrequently seen quite clearly. This organ has not the pliability of the liver and changes in size are readily discernable.

No distinct advantage has been gained by insufflation in diagnosing pathologic conditions of the gastrointestinal tract. The lower portion of the stomach may at times be clear, but the fundus and cardia are generally not seen. If the stomach is dilated, its posterior wall may be seen above the liver shadow and peristaltic movements easily followed. Peristalsis at the antrum may be recognized by a gradually decreasing wave running toward the pylorus and disappearing at that point. If the pylorus is open it also appears in the form of a small ring.

The combined method of gas distension and insufflation often gives valuable data in the diagnosis of gastroectane and gastroptosis. The small intestines are generally forced into the lower abdomen by the gas and are not easily distinguished. The first part of the colon may be readily made out in the left lateral position, especially after contrast insufflation. The transverse colon is seen in the right lateral position. The descending colon is difficult to make out as is also the sigmoid, which is covered by the bony pelvis in all positions.

In the knee chest position the mesentery of the small intestine spreads out like a fan. Normally it

manifests several strand-like thickenings. Shrinkage of the mesentery from disease produces an irregularity in its outline; a link of intestine may be drawn up and sharply kinked.

The pelvic organs may be demonstrated with the patient in the lateral position. The full bladder or enlarged uterus is easily recognized, as are also the adnexa or tumors of the rectum.

Adhesions are very easily seen, especially if they connect the abdominal wall and one of the intraperitoneal organs. Adhesive perihepatitis and perisplenitis are usually readily diagnosed, but perigastritis and perisigmoiditis are diagnosed with certainty only when there are adhesions to the anterior abdominal wall. In carcinomatosis of the peritoneum the areas of malignancy are often made out as small dense spots.

Fluid in the abdominal cavity may be recognized in quantities which are not demonstrable by physical examination.

The kidneys may be distinguished at times by appropriate lateral positions. Anomalies in position and diffuse or focal enlargements were noted in a number of cases. Valuable information may be obtained with regard to diseases of the abdominal wall or diaphragm, and in recognizing various types of hernia.

In the dorsal, lateral, or upright positions the diaphragm usually appears as a single or as a double line several centimeters apart. At times it is seen in the form of many intersecting curves, which probably signifies certain independence in contraction of the various diaphragmatic parts. Small pleural effusions are easily recognied in the phrenocostal angle. Pleural adhesions, as well as the contour and action of the heart are also demonstrable.

The method is easily carried out and if care is used in the selection of cases, it is not a dangerous procedure. The inconvenience to the patient is slight and valuable diagnostic data are often obtained, at times of such a nature as to obviate the necessity for an abdominal exploration. If properly indicated this method deserves to be employed as a diagnostic aid.

A. J. SCHOLL, JR., M. D.